2-WIRE FOREIGN EXCHANGE OFFICE (2WFXO9 AND 2WFXO6) CHANNEL UNIT, 628180, AND 2-WIRE FOREIGN EXCHANGE OFFICE WITH LOOP START (2WFXO/LS9 AND 2WFXO/LS6) CHANNEL UNIT, 628184

GENERAL DESCRIPTION

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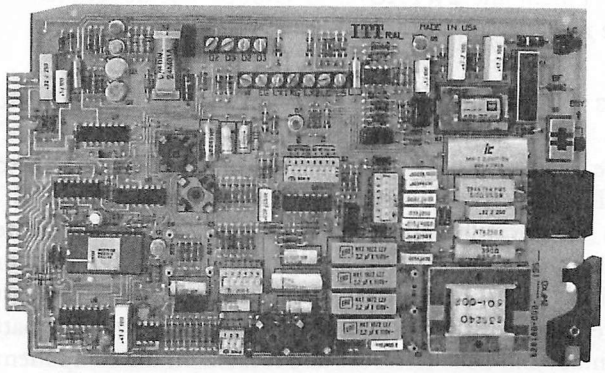

Fig. 1—2WFXO Channel Unit, 628180

TO BE SUPPLIED

919-828-4441

Fig. 2—2WFXO/LS Channel Unit, 628184

1. GENERAL

1.01 This Section provides a general description of the ITT D448 2-wire foreign exchange office (2WFXO9 and 2WFXO6) channel unit, 628180 (Fig. 1), and 2-wire foreign exchange office with loop start (2WFXO/LS9 and 2WFXO/LS6) channel unit, 628184 (Fig. 2), to the functional block diagram level.

1.02 This Section has been reissued to add information on Group -1 of the 2WFXO channel unit, to add coverage of the 2WFXO/LS channel units, and to include information on the handling of CMOS-equipped units.

1.03 The unit provides a voice frequency (VF) and signaling interface between the central office (C.O.) equipment and the D448 multiplex terminal common equipment. In the transmit direction, the unit converts VF and signaling information into pulse code modulation (PCM) for application to the common equipment. In the receive direction, the unit decodes received PCM into VF and signaling information. During system outages, the unit provides various disconnect/make-busy routines for the trunk. The unit provides the office end of a 900- or 600-ohm; ground-start or loop-start (2WFXO9 and 2WFXO6); or loop-start only (2WFXO/LS9 or 2WFXO/LS6) foreign exchange message circuit.

2. DESCRIPTION

2.01 The unit mounts in the D448 multiplex shelf (channel unit mounting section) in connectors J1A through J24A (for Digroup A) or connectors J1B through J24B (for Digroup B). Installation procedures for the unit are provided in Section ITTR-18-440.

2.02 The 628180 unit is available in two groups. Group -0 provides 900-ohm plus 2.16-uF impedance matching. Group -1 provides 600-ohm plus 2.16-uF impedance matching. Group -0 is designated by the mnemonic 2WFXO9. Group -1 is designated by the mnemonic 2WFXO6. The 628184 unit is available in two groups. Group -0 provides 900-ohm plus 2.16-uF impedance matching. Group -1 provides 600-ohm plus 2.16-uF impedance matching. Group -0 is designated by the mnemonic 2WFXO/LS9. Group -1 is designated by the mnemonic 2WFXO/LS6.

2.03 The unit consists of an epoxy-glass printed circuit board (PCB) and associated circuit components. The lower front edge of the PCB is fitted with a handle to facilitate insertion and removal of the unit from the shelf. An identification strip on the handle face indicates the unit mnemonic (2WFXO9, 2WFXO6, 2WFXO/LS9, or 2WFXO/LS6), last three digits of the model number, last three digits of the part number, and issue letter. The part number and issue letter are also located on the component side of the PCB.

2.04 The LC LED (DS1), the BSY switch (S5), and the splitting card jack (J1) are located on the front edge of the PCB.

2.05 Printed circuit wiring is etched on both sides of the PCB. The unit inputs and outputs are terminated in gold-plated contacts on the rear edge of the PCB. These contacts mate with a 60-pin contact edge connector on the rear of the multiplex shelf.

3. FUNCTIONAL OPERATION (FIG. 3 AND 4)

HYBRID

3.01 The hybrid is toll-grade and provides 28-dB (minimum) echo return loss and a 20-dB (minimum for 900-ohm) or a 19-dB (minimum for 600-ohm) singing return loss. Either the internal compromise network (by selecting DIP switch option [CN]) or an external precision balance network (PBN) may be used to balance the hybrid. Regardless of whether the internal compromise network or an external PBN is used, additional build-out capacitance may be paralleled across it by selecting DIP switch options [2] through [64]. Build-out capacitance from 0.002 to 0.126 uF in 0.002-uF steps may be selected. The NT and NR leads are brought out for connection to an external PBN. If an external PBN is used, the [CN] DIP switch should be opened (not selected).

TRANSMIT VF CIRCUIT

3.02 The incoming VF is transformer-coupled to the low-pass/high-pass filter where it is amplified and filtered. The gain applied to the input signal can be varied over a 3-dB range to compensate for VF input levels from 0 to −3.0 dBm (in 1-dB steps) by the selection of transmit (TX) prescription level DIP switch options [−1], [−2], or [−3]. The resulting signal is passed to the TX office wiring loss (OWL) compensation circuit. The TX prescription OWL options provide 0 to 1.5 dB of gain in 0.1-dB steps to the signal applied to the encoder to compensate for office wiring/cabling losses. The resultant range for input levels is 0 to −4.5 dBm in 0.1-dB steps.

3.03 The encoder converts the VF signal and signaling information (Para. 3.07) to an 8-bit PCM word. When the TX AND gate is activated by the transmit logic unit (TLU) on the TCS4-X and TCS6-X leads, the 8-bit word is applied to the TLU via the TCD bus. The data is clocked out of the unit under control of the 1.536-MHz clock from the TLU.

RECEIVE VF CIRCUIT

3.04 An 8-bit PCM word from the receive logic unit (RLU) is applied to the decoder on the RCD bus. The decoder will only accept the data when the receive (RX) AND gate is activated by the RLU on the RCS4-X and RCS6-X leads. The decoder converts the PCM word into a VF signal and signaling information (Para. 3.08).

3.05 The VF signal is applied to the low-pass filter and passed through to the RX OWL compensation circuit. The RX prescription OWL options provide 0 to 1.5 dB of gain in 0.1-dB steps to the signal out of the low-pass filter to compensate for office wiring/cabling losses. The output of this circuit is further amplified. This amplification can be varied over a 6-dB range (in 1-dB increments) by the selection of RX prescription VF level DIP switch options [−1] through [−6]. This provides output levels of +1.5 to −6.0 dBm in 0.1-dB increments with both the OWL and prescription VF level options. The amplified VF is transformer-coupled to the C.O. equipment.

SIGNALING

A. General

3.06 The following paragraphs describe ground-start operation (2WFXO9 and 2WFXO6) and loop-start operation (2WFXO9, 2WFXO6, 2WFXO/LS9, and 2WFXO/LS6). Loop-start signaling is similar between the

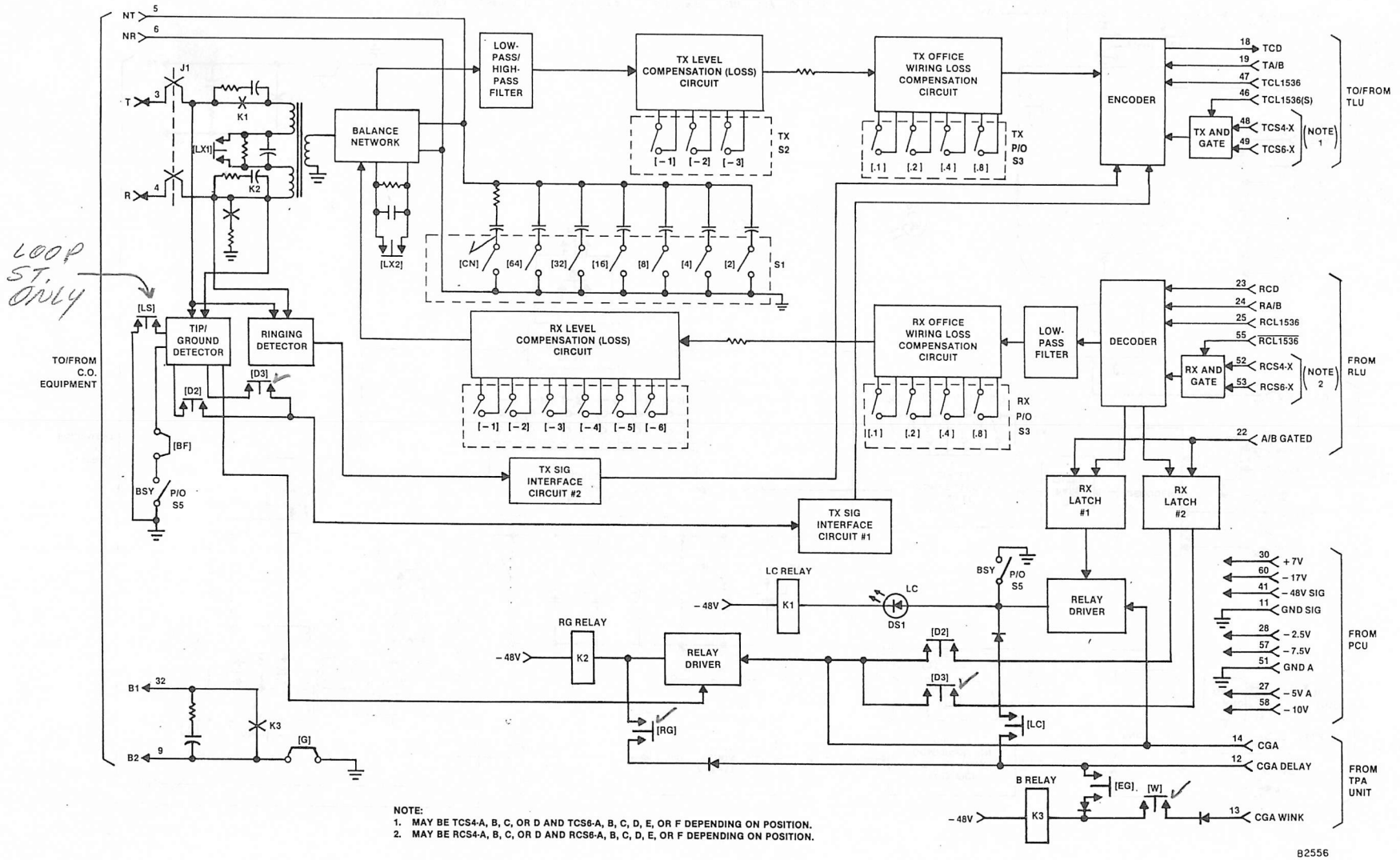

Fig. 3—2WFXO Channel Unit, 628180, Functional Block Diagram

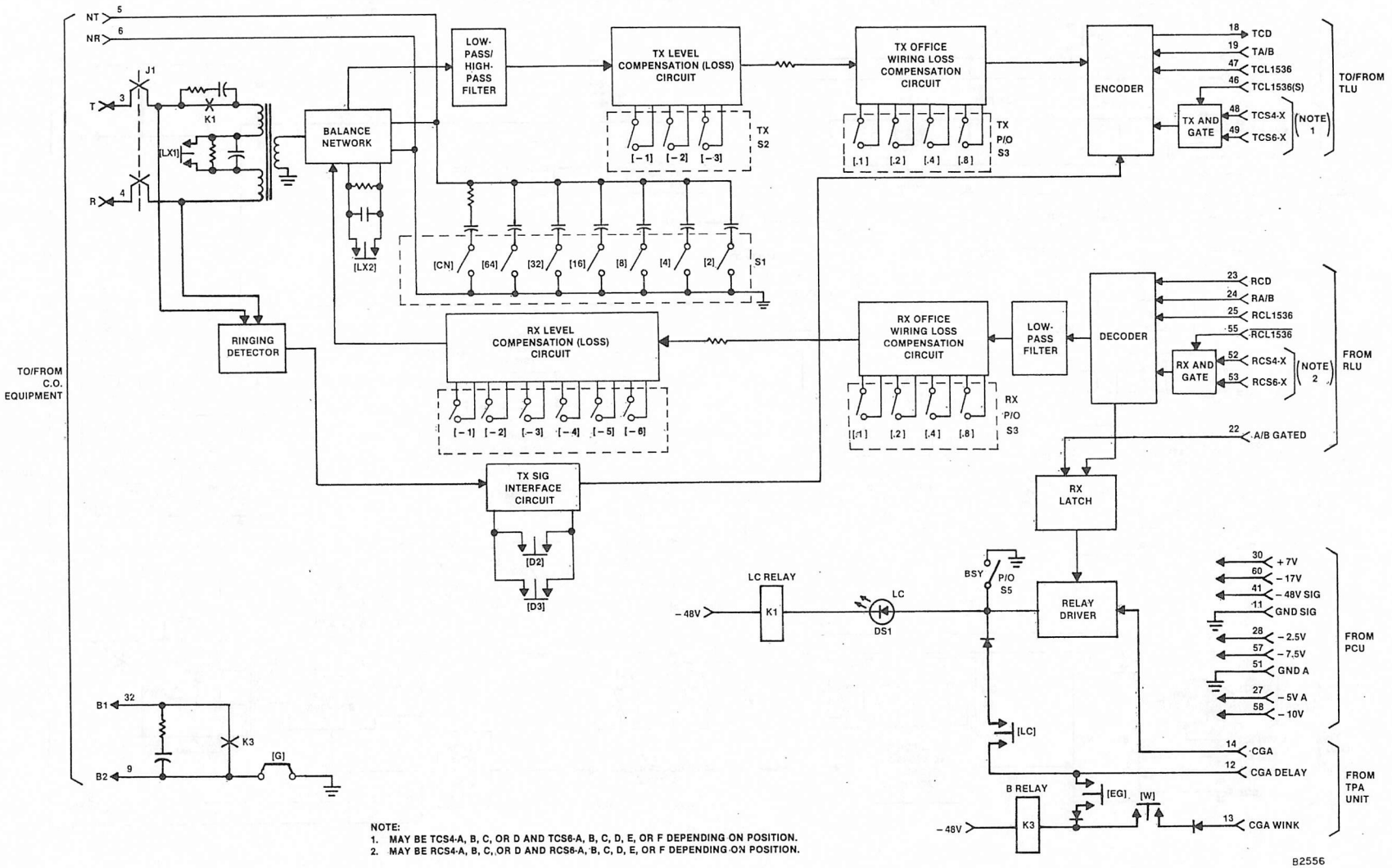

Fig. 4—2WFXO/LS Channel Unit, 628184, Functional Block Diagram

2WFXO and 2WFXO/LS units, except the 2WFXO/LS units have only one TX signaling (SIG) interface circuit, only one RX latch, and no tip-ground or ring-ground circuitry.

3.07 Signaling information from the C.O. to the unit is via the T and R leads. The signaling information is processed via signaling circuitry and the TX SIG interface circuits. The output of the TX SIG interface circuits is applied to the encoder. However, the encoder will not process the information until it is signaled on the TA/B lead by the TLU that the signaling frame is upcoming. Each TX SIG interface circuit is associated with a different signaling frame.

3.08 Signaling information from the far-end foreign exchange subscriber (FXS) channel unit is applied to the decoder along with the VF information from the far end. The decoder converts the receive signaling information from the 8-bit PCM word when it is signaled by the RLU on the RA/B lead that the signaling frame is being processed by the terminal. The decoded signaling information is applied to one of the RX latches. Each RX latch is associated with a different signaling frame. The RX latches and other receive signaling circuitry process the signaling information. This causes signaling conditions to be placed on the 2-wire drop to the C.O.

3.09 During intermittent terminal failures (momentary failures), the RX latch is inhibited from processing signaling information. This results in signaling state storage, which forces the unit to remain in its previous state (idle or busy) during the momentary failure to keep from dropping connections or to keep the unit from being accessed. The signaling state storage is controlled by the RLU. During a momentary failure, the RLU prevents the A/B GATED lead from making a transition which inhibits the RX latch.

B. Outgoing Call

3.10 The following paragraphs describe the signaling functions of the unit when a call is being processed from the C.O. to a far-end FXS channel unit.

3.11 The C.O. grounds the T lead and applies ringing voltage to the T and R leads. In loop-start operation, the C.O. maintains a permanent ground on the T lead, and ground is permanently applied to the tip/ground detector via option screw [LS]. Option screw [LS] is on 2WFXO9 and 2WFXO6 only. Selection of option screw [LS] grounds the tip/ground detector and converts the unit to loop-start operation. The tip/ground detector detects the presence of ground on the T lead (or through option screw [LS]) and signals the TX SIG interface circuit #1 to transmit this information to the far end. Option screws [D2] and [D3] condition the signaling to be compatible with D2-type signaling or D3-/D1D-type signaling, respectively. When the tip/ground detector detects the presence of ground, it inhibits the RG relay from energizing, thereby keeping the unit from grounding the R lead to the C.O. When the far-end FXS channel unit receives the tip ground information, it too grounds its tip lead. This completes part of its ringing path and inhibits it from sending a ring ground to the near end.

3.12 The ringing voltage on the 2-wire drop of the FXO channel unit is detected by the ringing detector. The ringing detector applies this information to the TX SIG interface circuit #2 for transmission to the far end. When the FXS channel unit receives the ringing information from the FXO, it completes its ringing path and applies ringing to its 2-wire drop to the subscriber. When the FXS senses a loop closure (off-hook) at the 2-wire drop, it trips ringing, and transmits the loop closure information to the FXO.

3.13 The loop closure information from the far end is applied to RX latch #1. RX latch #1 and the relay driver turn on the LC LED and energize the LC relay. This causes the 2-wire drop to the C.O. to be closed. This trips ringing at the C.O. and completes the talk path from the FXO to the FXS.

C. Incoming Call

3.14 The following paragraphs describe the signaling functions of the unit when a call is being processed from the far-end FXS to the C.O.

3.15 The FXS at the far end is seized when its loop is closed. In ground-start operation, its ring lead is grounded at the same time. In loop-start operation, a permanent ground is placed on its tip lead by the FXS.

3.16 In ground-start operation, the FXS does not recognize the loop closure because its tip lead is open. It sends its ring ground condition to the FXO. The ring ground information is applied to the RX latch #2. RX latch #2 and the relay driver energize the RG relay. This grounds the R lead to the C.O. The C.O. recognizes this as a request for service from the FXS and grounds the T lead to the FXO. This is detected by the tip/ground detector which sends this information to the far end via TX SIG interface circuit #1. This signal also causes the RG relay to deenergize. When the far-end FXS receives the tip ground

information, it too grounds its tip lead. This completes its loop at the 2-wire drop and permits dialing to take place. Dialing occurs by pulsing of the loop at the FXS. The FXS transmits this condition to the FXO. The loop pulsing information from the far end is applied to RX latch #1. RX latch #1 and the relay driver pulse the LC LED on/off and energize and deenergize the LC relay to recreate the dial pulsing at the 2-wire drop to the C.O. At the conclusion of dialing, the talk path from the FXS to the FXO is complete.

3.17 In loop-start operation, the tip lead at the FXS is permanently grounded. When the loop at the FXS is closed, this ground is applied to the ring lead. This condition is transmitted to the FXO. The loop closure information is applied to the RX latch #1. RX latch #1 and the relay driver energize the LC relay. This closes the loop to the C.O. The C.O. recognizes this as a request for service from the FXS. Since the loops at both ends are now complete, dialing from the FXS can now take place. Dialing occurs by pulsing of the loop at the FXS. The FXS transmits this condition to the FXO. The loop pulsing information from the far end is applied to RX latch #1. RX latch #1 and the relay driver pulse the LC LED on/off and energize and deenergize the LC relay to recreate the dial pulsing at the 2-wire drop to the C.O. At the conclusion of dialing, the talk path from the FXS to the FXO is complete.

CARRIER GROUP ALARM

3.18 During a system outage, three carrier group alarm (CGA) signals (CGA immediate ground, CGA wink, and CGA delay); option screws [RG] (on 2WFXO6 and 2WFXO9 only), [LC], [EG], and [W]; and option strap [G] control the CGA functions of the unit. When a CGA occurs, the CGA lead provides an immediate ground to the unit, and the CGA DELAY lead provides a delayed ground to the unit. Both grounds remain until the CGA condition is cleared. The CGA WINK lead also provides an immediate ground to the unit, but is opened after a delay, and is then returned to ground until the CGA is cleared. Strapping options on the backplane of the multiplex shelf control when the CGA immediate ground occurs after an alarm signal is received and when the wink pulse (open) occurs after the CGA.

3.19 When the CGA lead is grounded, both the LC and RG relays are deenergized (RG relay on 2WFXO9 and 2WFXO6 only). This opens the loop at the 2-wire drop and, on 2WFXO9 and 2WFXO6, removes the ground from the R lead.

3.20 When the CGA DELAY lead is grounded, and option screw [LC] is selected, the LC relay is energized and the LC LED is turned on. This closes the loop at the 2-wire drop. On 2WFXO9 and 2WFXO6, if option screw [RG] is selected, the RG relay is energized causing a ground to be applied to the R lead.

3.21 The B2 lead is normally grounded via option strap [G]. If [G] is removed, ground must be provided on pin 9 by the C.O. equipment. On operation of the B relay, ground on the B2 lead is looped to the B1 lead to signal a CGA condition to the C.O. equipment. The B relay will operate from either the CGA wink lead (option [W]) or the CGA delay lead (option [EG]).

BUSY MODE

3.22 When the BSY switch is placed in the BSY position, the LC relay is energized and the LC LED is turned on. This causes a loop closure at the 2-wire drop. On 2WFXO6 and 2WFXO9, with option strap [BF] installed, a continuous ground is applied to the tip/ground detector which is forwarded to the far-end FXS.

4. OPTIONS

4.01 The unit is equipped with DIP switch options, screw-down options, and strapping options for selecting circuit options. Refer to Section ITTR-18-440 for detailed information on option selection.

4.02 The multiplex shelf provides options on the backplane which control the CGA timing of the terminal. Refer to Section ITTR-18-405 (for shelves mounted in 23-inch bays) or ITTR-18-406 (for shelves mounted in 19-inch bays) for option selection information on these options.

5. RESTRICTIONS

WARNING: This unit contains static-sensitive (CMOS) devices. Section ITTR-18-599 contains handling instructions for CMOS-equipped units.

6. TEST AND MAINTENANCE FEATURES

6.01 A description of the test and maintenance features of the unit is provided in Table A. Refer to Fig. 1 and 2 for the physical location of these features.

TABLE A

FEATURE	REF. DES.	FUNCTION
LC LED	DS1	Turns on when a loop closure is present at the 2-wire drop.
BSY Switch	S5	When placed in BSY position, causes loop closure at 2-wire drop; with option strap [BF] installed on 2WFXO6 and 2WFXO9, tip ground also sent to far end.
Splitting Card Jack	J1	Provides test/break jack access to C.O. equipment and channel unit drop sides of T and R leads.

7. TECHNICAL SUMMARY

7.01 A summary of technical specifications for the unit is given in Table B.

TABLE B

ITEM	SPECIFICATION
DC POWER	
Voltage	**Current Drain (nominal)**
−5V	27 mA
−10V	2.0 mA (at 5V)
+7V	5.0 mA (at 12V)
−17V	10.0 mA (at 12V)
−48V Signaling Battery	
2WFXO9 and 2WFXO6	2.5 mA (idle); 11.0 mA (busy)
2WFXO/LS9 and 2WFXO/LS6	0.1 mA (idle); 8.0 mA (busy)
VF PERFORMANCE	
Impedance	
2WFXO9 and 2WFXO/LS9	900 ohms plus 2.16 uF
2WFXO6 and 2WFXO/LS6	600 ohms plus 2.16 uF
Levels	
Transmit	0 to −4.5 dBm, adjustable in 0.1-dB steps
Receive	+1.5 to −6.0 dBm, adjustable in 0.1-dB steps

TABLE B (CONT)

ITEM	SPECIFICATION
Loss Stability (End-to-End)	±0.5 dB over life in 95% of the circuits
Tracking (End-to-End)	
−37 to +3 dBm0 Input	0.5 dB maximum deviation
−50 to −37 dBm0 Input	1.0 dB maximum deviation
Idle Channel Noise (End-to-End)	23 dBrnc0 maximum
Signal-to-Distortion	
0 to −30 dBm0 Input	33 dB minimum overall; 35 dB minimum receive or transmit
−40 dBm0 Input	27 dB minimum overall; 29 dB minimum receive or transmit
−45 dBm0 Input	22 dB minimum overall; 25 dB minimum receive or transmit
Single Frequency Distortion (at 0 dBm0)	
Input Swept from 0 to 12 kHz	−28 dBm0 maximum at any other frequency
Input between 1004 and 1020 Hz	−40 dBm0 or less at any other frequency of 0 to 4 kHz with a distortion contribution objective from either transmit or receive of typically 6 dB better
Transhybrid Loss (900 ohms)	
200 to 500 Hz	20 dB
500 to 1000 Hz	30 dB
1000 to 2500 Hz	35 dB
2500 to 3400 Hz	30 dB
Transhybrid Loss (600 ohms)	
200 to 500 Hz	20 dB
500 to 1000 Hz	27 dB
1000 to 2500 Hz	27 dB
2500 to 3400 Hz	27 dB
Echo Return Loss (Measured against nominal impedance with 25 ohms in series with channel unit and no far-end channel unit)	28 dB minimum

TABLE B (CONT)

ITEM	SPECIFICATION
Singing Return Loss (Measured against nominal impedance with 25 ohms in series with channel unit and no far-end channel unit)	20 dB minimum (900 ohm); 19 dB minimum (600 ohm)
Frequency Response (Referenced to 1020 Hz, End-to-End)	
(900 ohms)	
60 Hz	20.0 dB minimum loss
200 Hz	0 to −5.0 dB
300 to 3000 Hz	+0.5 to −1.0 dB
3200 Hz	+0.4 to −1.5 dB
3400 Hz	0 to −3.0 dB
(600 ohms)	
60 Hz	20.0 dB minimum loss
600 to 2400 Hz	±1.0 dB
300 to 3400 Hz	−1.0 to −3.0 dB
Balance Network	Compromise network of 900 or 600 ohms + 2.16 uF built-in and with BOC in 0.002-uF steps to 0.126 uF (NT and NR brought out for connection to external precision balance network)
Delay Distortion (End-to-End)	94 PAR (minimum)
Longitudinal Balance (AT&T or IEEE Method)	
200 Hz	66 dB minimum
1000 Hz	60 dB minimum
3000 Hz	58 dB minimum
SIGNALING	
Pulsing Distortion	
Input (at FXS)	Loop pulsing at 12 pps, 64% break, with 1500 ohms external circuit resistance
Output (at FXO)	71% break maximum
Input (at FXS)	Loop pulsing at 12 pps, 58% break, 4 C4A ringers, and 15 k ohms leak resistance

TABLE B (CONT)

ITEM	SPECIFICATION
Output (at FXO)	43% break minimum
Loop Closure Resistance	600 ohms nominal
Ring/Ground Resistance	390 ohms nominal
External Loop Resistance	1800 ohms maximum
Ringing Voltage (at office)	84 Vrms minimum
OPERATING ENVIRONMENT	
Temperature	0 to +55°C
Humidity	To 95% at 40°C (no condensation)
Altitude	To 14,000 ft (4,300 m)
DIMENSIONS	
Width	0.8 in. (1.9 cm)
Height	5.9 in. (15.0 cm)
Depth	9.7 in. (24.6 cm)
WEIGHT	1.0 lb (0.5 kg)

8. REPLACEABLE PARTS

8.01 This unit has no field-replaceable parts.

9. REFERENCES

9.01 The engineering drawings noted in Table C were used in the preparation of this Section.

TABLE C

TYPE	DRAWING NO.
Assembly	628180-000
Schematic	628180-002
Assembly	628184-000
Schematic	628184-002

9.02 Related information on the channel units may be found in the ITTR Sections referenced in Table D.

TABLE D

TITLE	SECTION NO.
Connectorized Multiplex Shelf (MS/WC7, MS/WC5, MS/C7 and MS/C6), 628001, 628005, 628011 and 628015 (For 23-Inch Bays) — Option Selection, Installation and Pretest	ITTR-18-405
Connectorized Multiplex Shelf (MS19/WC7, MS19/WC5, MS19/C7 and MS19/C6), 628003, 628008, 628013 and 628018 (For 19-Inch Bays) — Option Selection, Installation and Pretest	ITTR-18-406
Trunk Channel Units — Option Selection and Installation	ITTR-18-440